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MINISTRY OF TECHNOLOGY

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT

BOSCOMBE DOWN

HESSEX HU MK. 5 XT 484

DECK LANDING TRIALS ON RFA LYNESS BY DAY AND NIGHT

PRESENTED BY

G. M. J. DAVIS, PERFORMANCE DIVISION AND LT. C. J. HORSCROFT, RN, FLYING DIVISION

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7th Part of Report No. AAEE/931/2
4th December, 1967.

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A&AEE Ref: A&F/107/08
Period of Trial: 15th and 16th March, 1967

Summary

Trials have been conducted to establish the limits for operating Wessex helicopters from the flight deck of Royal Fleet Auxiliaries of the WAVENEY Class.

Landings and take-offs were made by day and night, on board RFA Lyness, (15,000 tons) and recommendations are made for Service use.

This report is issued with the authority of

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/1. Introduction

1. Introduction

Deck landing trials have been carried out on the Royal Fleet Auxiliary Lyness in conjunction with the Naval Air Department at RAE Bedford and the Royal Navy, to define the limits for operating Wessex helicopters from the flight decks of MESS Class RFAs.

The trial took place off Portland on the 15th and 16th March, 1967.

2. A brief description of the ship

RFA Lyness was a new auxiliary ship of 15,000 tons designed for the Royal Navy as an air stores supply ship.

The large flight deck was situated at the aft end of the ship and was about 45 feet above the water line. The shape of the flight deck followed the outline of the ship, so that it tapered towards the stern and was rounded at the stern. The flight deck had an appreciable slope forward, the aft end was about 3 feet higher than the centre point of the large white "T" painted on the deck. A small box was painted on the "T" to indicate the optimum landing position for the main wheels of the helicopter. Well forward of the landing "T" was a flush fitting stores lift; also aircraft lashing points were provided in this area. The deck was unobstructed except for a deck house at the forward end. The nearest superstructure, on which was built the funnel, was amidships, but between this superstructure and the flight deck was a large cargo derrick.

Stop/Go lights, relative windspeed and direction indicators, and RT/briefing facilities were provided for the Flight Deck Officer (FDO) in the starboard side of the deck house. Stop/Go lights were duplicated at the port side of the aft end of the flight deck.

Lighting for night flying consisted of four red floodlights, white uni-directional outline "T" lighting, a horizon bar and a Glide Path Indicator (GPI) set to give a 3° glidepath at a relative heading to the ship of Red 165. The latter two were mounted on the cargo derrick; dimming controls were provided in the port side of the deck house.

The general layout of the facilities mentioned above is shown in Figs. 1 and 2, Fig. 1 being photographs of RFA Lyness.

3. Trials helicopter

The trials helicopter, a Wessex Mk. 5 XT 484 from RNAS Culdrose, was fitted with a small amount of instrumentation by RAE Bedford to record various parameters during touch-down on all landings.

The helicopter was flown within the limitations laid down in Pilots' Notes at AUWs up to 13,000 lb. at approximately central C of G. It was piloted jointly by two experienced Royal Navy pilots and an A&AEE pilot, who was aboard the helicopter for all the flying.

4. Day-time landings and take-offs

69 deck landings and take-offs were made within the relative wind limits given below, two landings being made at each condition.

/Table

Wind relative to the ship	
Direction	Speed
0° to 20° Red and Green	Up to 45 knots
20° to 90° Red and Green	Up to 30 knots
90° to 180° Red and Green	Up to 15 knots

The ship's motion was slight throughout and well within the limits which had been previously defined, i.e , ±2° in pitch and ±5° in Roll.

Approaches were mostly made on a relative bearing of Red 165 to a hover off the port side of the flight deck, the exception being when the athwartships wind component was more than 15 knots from port in which case approaches were made from starboard. In addition approaches were made from starboard with the wind abaft the port beam, with the helicopter landing facing aft on the flight deck. The helicopter was normally landed facing forward, but with an athwartships component of more than 15 knots the aircraft was landed approximately into the relative wind.

The flight deck was easily seen from any approach angle. With the helicopter facing forward on the deck, the FDO was, in the initial stage of the trial, too close to the centre line and the pilot lost sight of him during the final stages of landing. This problem was aggravated by all three pilots wishing to make slightly higher approaches over the deck (10 to 15 feet clearance) than the FDC wanted (5 feet). When the FDC was repositioned further to starboard this problem was resolved, with the pilots still preferring the higher approach. Two FDCs were present, one very experienced but basically on Wasp helicopters, hence his preference for the lower approach height, and the other the ship's own FDO who at the start of the trial had no practical experience. For landings athwartships (port or starboard), the FDC was repositioned close to the starboard nose of the aircraft; these positions were still satisfactory. For landings facing aft the FDC's position was on the port side right aft; this position was satisfactory except that the RT/briefing cable was not long enough at this position.

It was noted that the FDO in some circumstances was not able to see whether all lashings were removed before take-off. Some confusion existed occasionally owing to the inexperienced state of the handlers, and it was found desirable to have a responsible rating on the blind side of the aircraft to the FDC who signalled to the FDC that these lashings were on or off as appropriate, especially as the pilot was not able to see for himself.

In general, turbulence levels, around the flight deck were low, due presumably to the comparative absence of high superstructure above the landing area. In winds greater than 30 knots turbulence was occasionally encountered in the final stages of the approach and also just before touchdown; but this caused no difficulty. With the wind ahead at 30 knots or more there was a noticeable reduction of wind just before landing, with a resultant tendency to sink more rapidly than was intended. During the final stages of approach, the aircraft frequently flew through the funnel smoke (which was barely visible) -

/no

no change in turbulence levels were noted but the smoke was readily smelt. The smoke was well above the aircraft in the final stage of landing. Large changes of ship's power required produced moderate quantities of thick smoke as the throttles were opened, but this state only lasted for a few seconds and was not a problem during the trial. No problem was found landing the aircraft accurately on the deck. At first the tendency was for the main wheels to be just forward of the "T" box, but discussion with the FDC remedied this. When facing to either beam the aircraft was still easily placed over the "T", and just aft of the cross bar, and when facing aft the aim of having the tailwheel in the box was easily achieved. The large size of the deck made precise accuracy unnecessary.

With the aircraft facing forward, the tailwheel touched down first. This was due to the natural tail down lowering attitude of the Hessex and aggravated by the down slope of the deck (see Fig. 3A). Further, the left mainwheel tended to touch just before right.

As a result of this, slight "padding" (incipient ground resonance) was experienced frequently (about half the landings) and "padding" was severe on four occasions, necessitating immediate lift-off of the aircraft. When the aircraft was facing to either beam, or especially astern (see Fig. 3B) (when the main and tail wheels touched almost simultaneously) "padding" was almost non-existent.

No landings with the wheel brakes off (or failed) were made as it was thought that the slope of the deck might cause the helicopter to roll forward into the deck house if not checked immediately.

To observe the behaviour of the rotor blades during the shut down of the engines, the rotor was stopped on five occasions - once with the aircraft facing to each beam and astern, and twice facing ahead.

There was no sign of blade sailing during rotor engagement on start-up.

The relative wind was light (below 10 knots) when facing astern and to the beam, but up to 35 knots when facing ahead. Under the latter conditions, very slight signs of blade sailing were apparent on shut down, but not of sufficient extent to cause any danger.

5. Night-time landings and take-offs

31 deck landings and take-offs were made in dark conditions within the relative wind limits given below, two landings were made at each condition. All landings were made facing ahead.

Wind relative to the ship	
Direction	Speed
0-30° Red and Green	Up to 25 knots

The same comments as for day flying applied where appropriate with the following additional comments on the lighting.

/(a)

(a) The GPI was easily seen when within about one mile of the ship. It was noted that the GREEN looked very much like white (during the early part of the approach) for some time - much more so than in day-light. Brilliance control was good.

(b) The Horizon Bar was also easily seen and the brilliance control good. It was visible right up to the final stages of approach, but was not used when the aircraft was closer than about 50 yards as the deck could then be seen clearly. It was useful however in the earliest stages of take-off, before it disappeared below the aircraft. The two centre line lights below the centre light of the bar were not felt by the A&AEE pilot to be of any assistance in judging the centre line, though it is understood that in the installation these have been asked for by aircrew. The pilot also found the GPI amber became "lost" in these two lights on some occasions.

(c) The "T" Outline Lighting was good, the brilliance control also being good. The intensity was adjusted to a low level as the trial progressed.

(d) At the beginning of the night flying trials the Red Floodlighting was used at full intensity but this was reduced to about half the brilliance by the end of the trial. Some approaches were made with the red floodlights off, the A&AEE pilot finding things neither better nor worse than with them on. The other (RN) pilot liked them on, and the ship also preferred them on.

(e) The lighting of the ship for helicopter operation was considered to be satisfactory, but it was found necessary to ask for the ship to be darkened aft of the funnel, (i.e. dowsing of all extraneous lights) to avoid confusion resulting from the large numbers of lighted scuttles below the flight deck. With the ship darkened, the deck lighting was considered good throughout. It was thought that further improvement for the pilot could have been obtained if the lights in the funnel casing/ventilator trunking had also been dowsed. Although the mast displayed the normal obstruction lighting, the tops of the after derricks were unlit. It was noted on one occasion after a normal night lift-off (climbing away to port and forward whilst facing ahead) that the aircraft came very close to the port derrick top. These tops were well (70 ft.) above flight deck level and at this stage of take-off virtually all other reference lighting had been lost.

(f) The dimming facilities for the night lighting which were located in the deck house on the port side were not within easy reach of the FDC. It is considered that the dimmers should be repositioned on the starboard side, adjacent to the FDOs normal position.

(g) In addition to the normal aircraft lighting, downward facing low intensity deck landing lights were fitted to the Wessex (in addition to the normal adjustable high intensity landing light which was not used). The pilot was not aware of any illumination from these lights but the ship commented adversely when they were switched off.

6. Conclusions

6.1 Relative wind strength and direction

The natural wind conditions prevented a complete examination throughout the planned relative wind ranges, but all three pilots considered that stronger relative wind up to the planned levels would result in no serious adverse effects becoming apparent, particularly as the wind speed as measured on deck was always less than that shown by the ship's anemometer.

/6.2

6.2 Ship's Motion

Similarly, though the ship's motion was slight throughout the trial, the size of the deck and the lack of severe turbulence around it should ensure that satisfactory take-offs and landings could be made within the ship's motion limits defined in para. 7.

6.3 Helicopter headings

The helicopter was normally landed heading forwards but other headings into the relative winds were quite satisfactory for day-time operation, as were approaches from directions other than those made from the port side. The flight deck and the FDC could be seen satisfactorily.

Turbulence and funnel smoke appeared only to have a minor affect on the handling of the aircraft and even this could be avoided, if the approaches were made from the port side with the relative wind from ahead or "fine" on the port bow.

6.4 Rotor starting and stopping

No blade sailing problems should arise in stopping or starting rotors in wind conditions up to the recommended limits, provided the aircraft is facing into the relative wind.

6.5 "Padding"

The number of occasions on which "padding" occurred during landing was undesirably high. This may be aggravated in other conditions of AUW, C of G, ambient temperature and severe ship motion. The slope of the flight deck was thought to be contributory to these occurrences as the pilots found it difficult to place all three wheels down together.

6.6 Night lighting

This was satisfactory except for the absence of after derrick obstruction lights. Night operation was made much easier if the ship's extraneous lights aft of the funnel were dowsed and with only the ship's helicopter operating lights showing.

7. Recommendations

7.1 Limits for take-off and landing

It is recommended that the class be cleared to operate Wessex helicopters within the following limitations (all relative speeds from ship's anemometer).

(a) By day (see also Fig. 4)

Wind relative to the ship		Wind relative to the helicopter
Direction	Speed	
0-20° Red & Green	45 knots	Sideways components to be less than 15 knots
20-90° Red & Green	Decreasing linearly from 45 knots to 30 knots	
90-180° Red & Green	15 knots	

/ship's

Ship's motion not to exceed ±2° in pitch; ±5° in roll, and yaw to be kept to a minimum.

(b) By night (see also Fig. 5)

Wind relative to the ship		Helicopter relative to the ship
Direction	Speed	
0-30° Red & Green	35 knots	Forward facing landings only
30-90° Red & Green	Decreasing linearly from 35 knots to 5 knots. Minimum wind speed is 3 knots	

Ship's motion not to exceed ±1½° in pitch; ± 3° in roll, and yaw to be kept to a minimum.

(c) Stopping and starting rotors

The limiting wind relative to the helicopter for stopping and starting rotors is as follows.

Wind Direction	Wind speed (knots)
0	40
±30°	30
±90°	20

7.2 Slope of flight deck

Pilots should be warned of the tendency to "padding" on landing, particularly when using the part of the deck which slopes forward.

7.3 Provision of obstruction lights

The after derricks should be marked near their highest points with red obstruction lights (showing at least to the aft sector).

7.4 Re-location of light dimming facilities

It is recommended that the night lighting control dimmers now located in the deck house port side, be repositioned on the starboard side, adjacent to the FDC's normal position.

7.5 FDC's Briefing/RT Lead

Some means should be found of enabling the FDC to retain his briefing/RT facilities when in his alternative position for helicopter landings facing aft.

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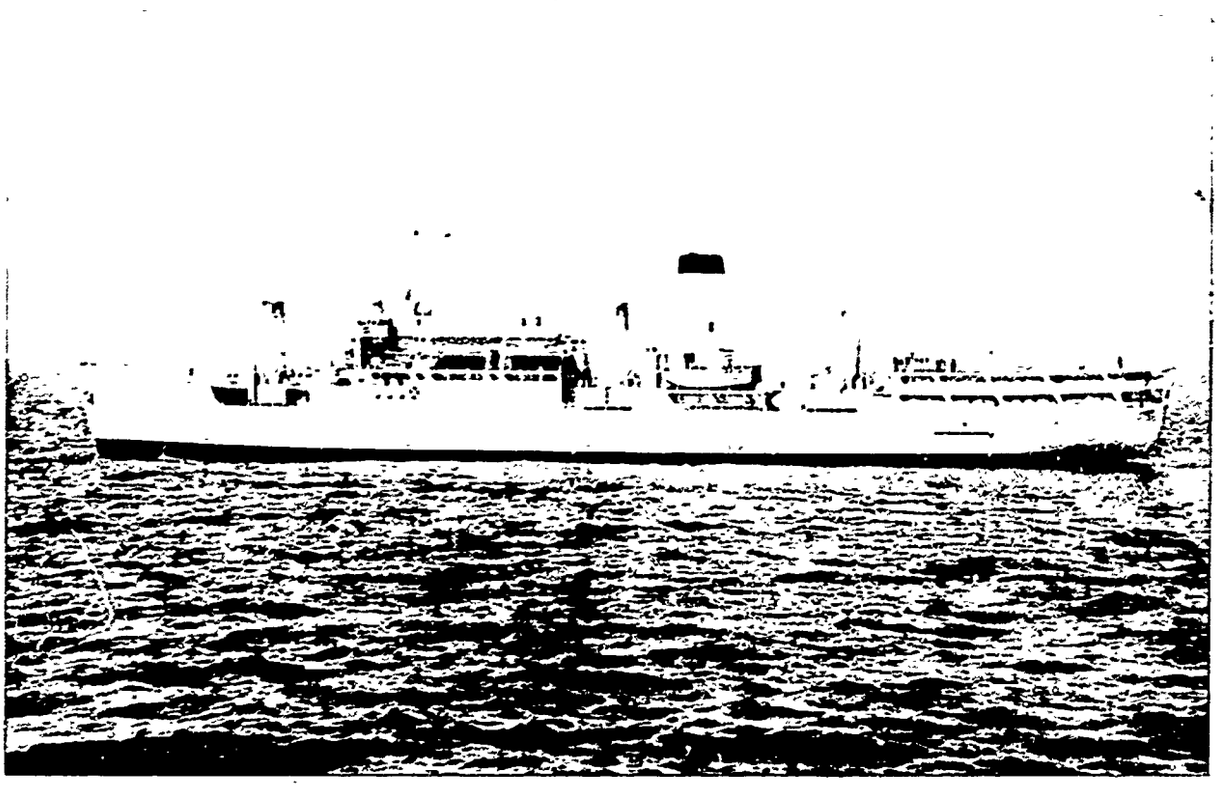
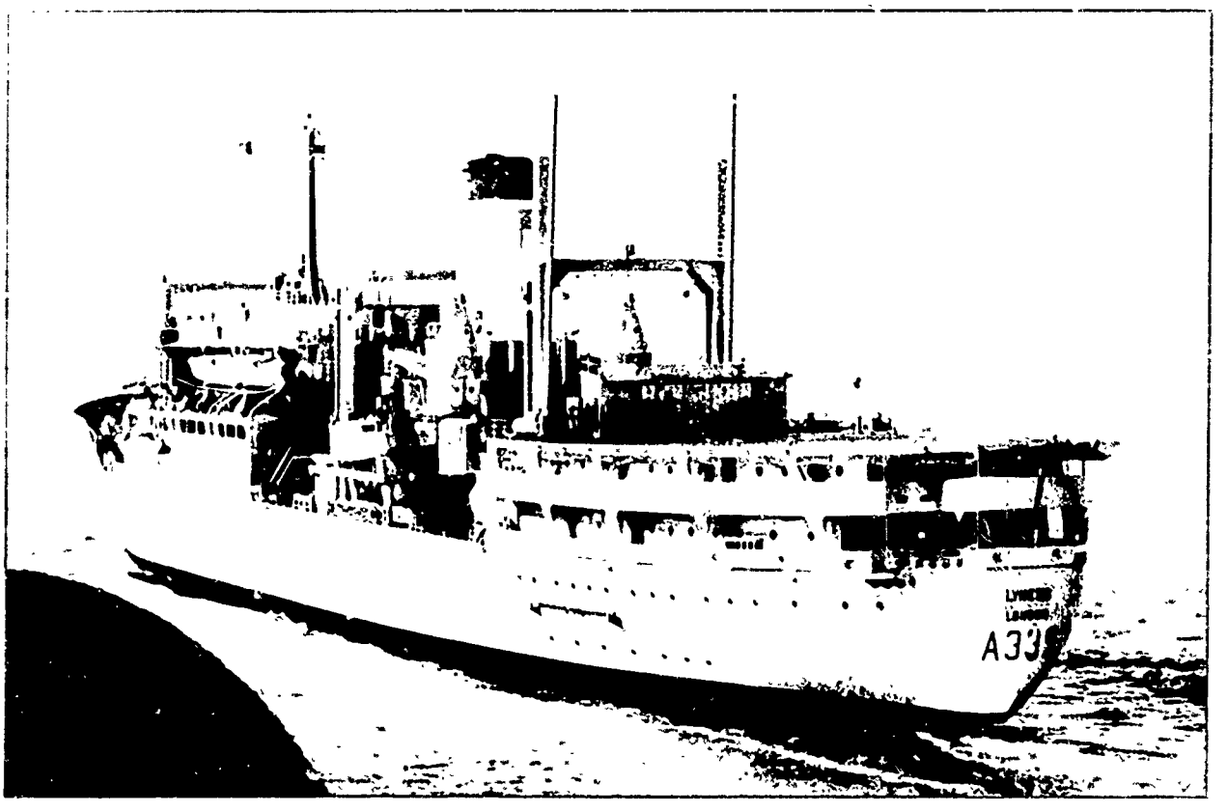
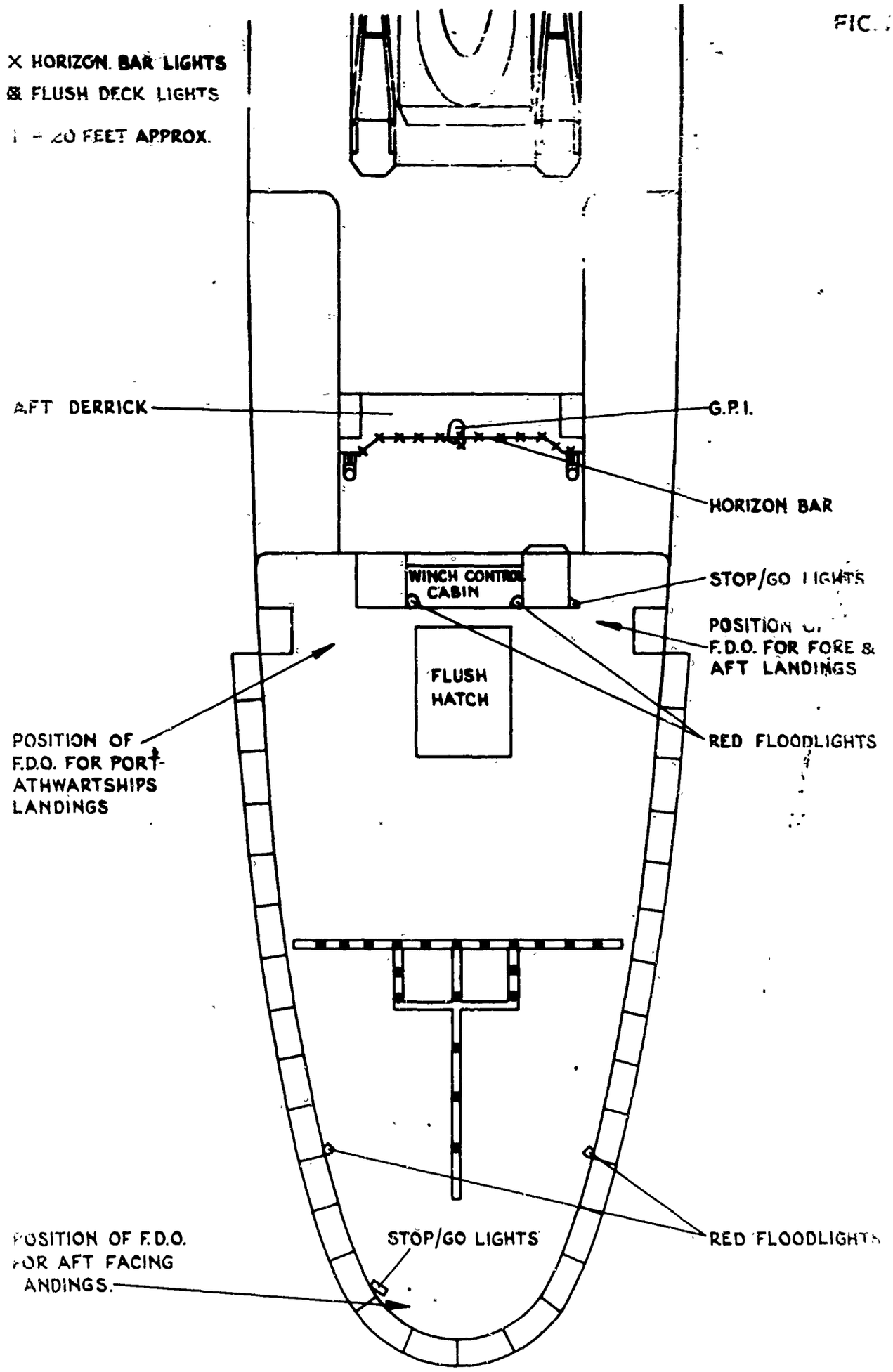




R.F.A. LYNESS. (15,000 TONS).

FIG. 1.

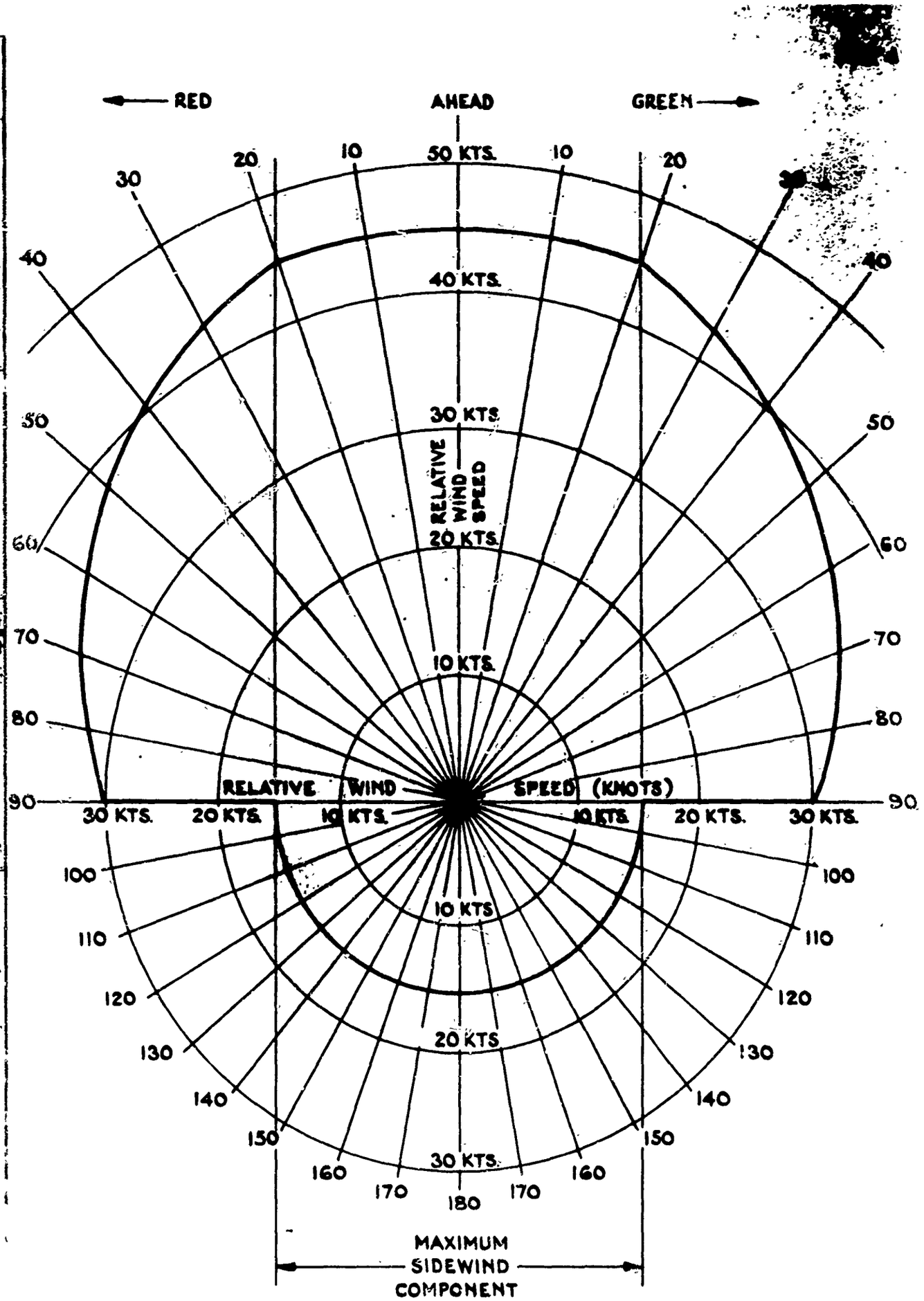
FIG.



A SKETCH OF THE LAYOUT AND POSITION
OF THE APPROACH AND LANDING AIDS OF R.F.A. LYNESS

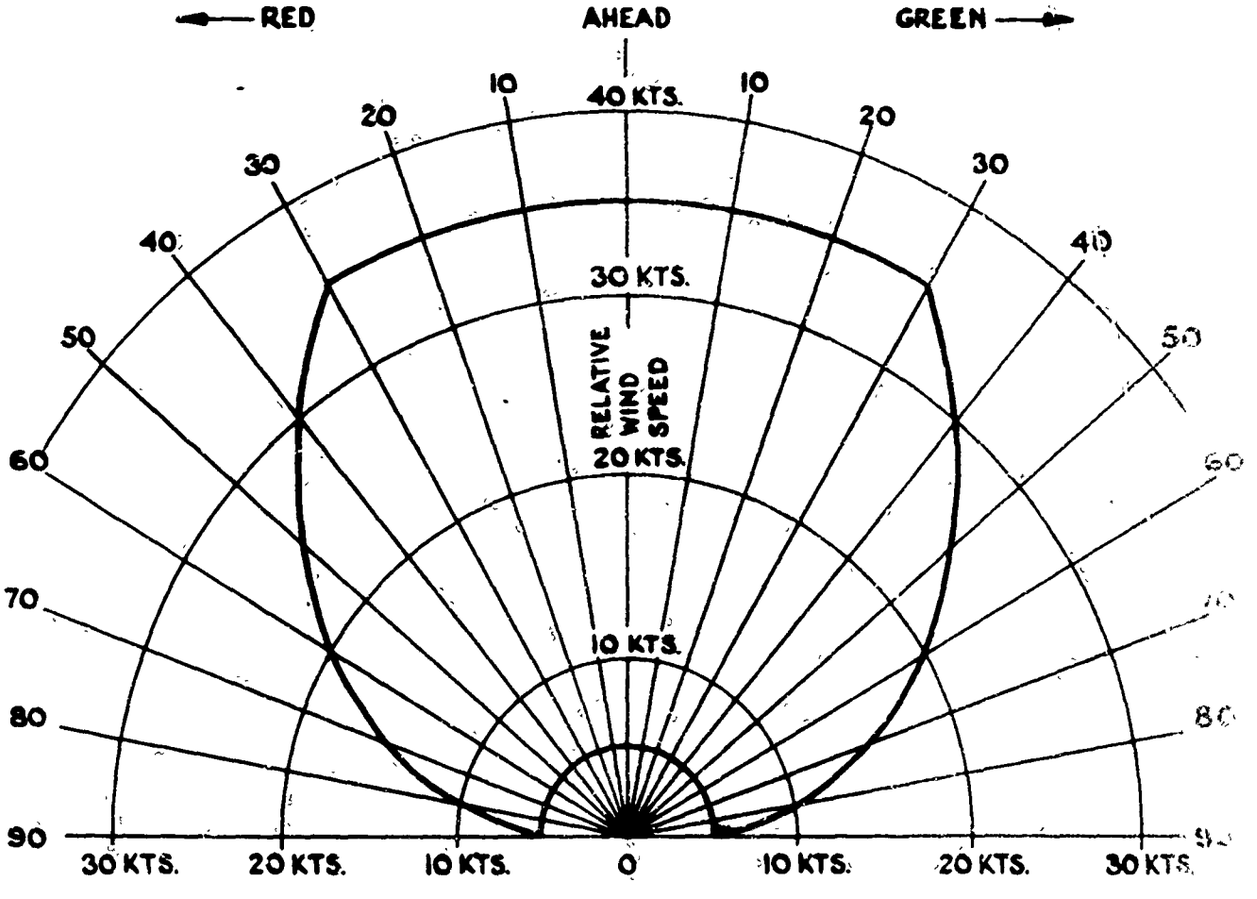
FIG. 3A. R.F.A. LYNESS. - A FORWARD FACING LANDING OF THE WESSEX MK.5. XT 484.

FIG. 3B. R.F.A. LYNESS. - THE WESSEX MK.5. XT 494 LANDING ABAFT THE BEAM.



R.F.A. LYNESS LIMITATIONS IN RELATIVE WIND SPEED AND DIRECTION FOR DAY TIME OPERATION

FIG. 5



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